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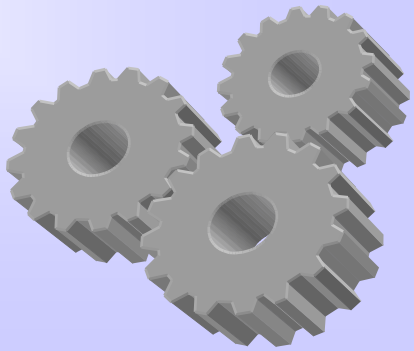
Powertrain Laser Workstations & Process Controls

By Jack Evanecky

Kokomo Transmission Plant

Background

- 3 Million Sq.ft. Facility
- Began Laser Welding in early 1970's
- Production Volume 7750 Units per day
- 24 CO_2 Laser Welding Systems



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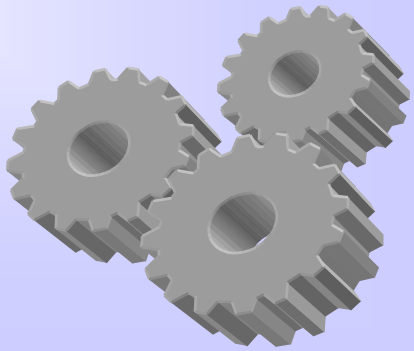
Indiana Transmission Plant

Background

- 1.4 Million Sq.ft. Facility
- Began Production of the 45RFE in 1997
- Production Volume 3200 Units per day
- 20 CO_2 Laser Welding Systems



Obstacles to Overcome

Machine Integrator

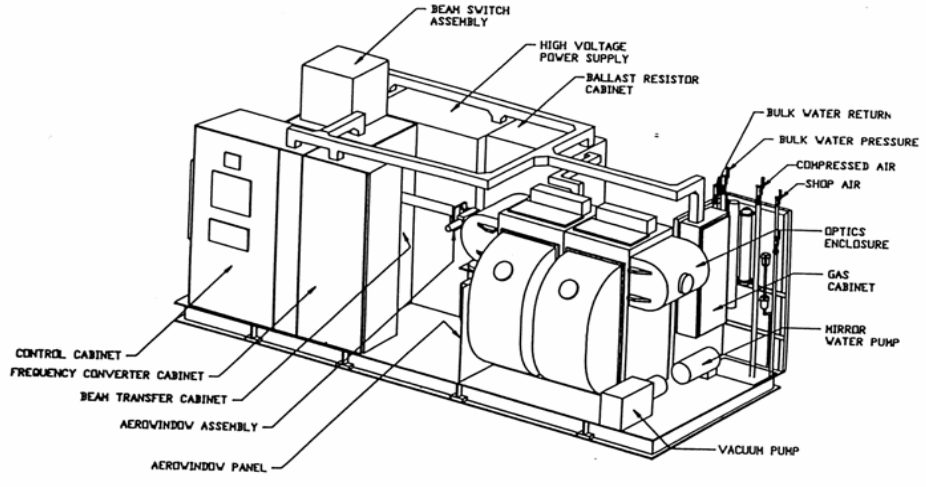
- Realize Existing Problems
- Accept New Designs
- "Think Outside The Box"

Past Practices

- What Works & What Does Not
- Better Application Knowledge

Identify The Needs

- Decrease Operating Cost
- Reduce Maintenance Cost
- Lower System Cost
- Improve Laser Uptime
- Process Control



Transverse Flow Laser

ITP Workstation Results

- Cost effective design
- Higher quality laser beam
- Higher throughput
- Twin spindle

Previous Workstation Design

- Two Station DialTable
- Single Spindle
- Weld LiftSlide
- Three Position PartShuttle

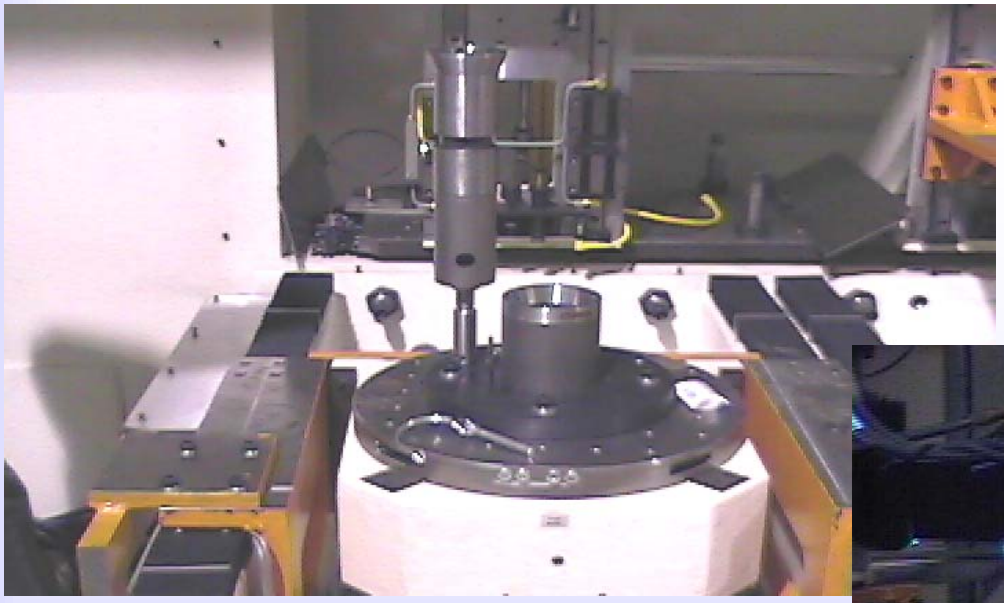
Previous Workstation Design Cont.

- Target Cycle Time 13.5sec.
- Current Cycle Time 16 to 20sec.
- Workstation Accounts for 45% Of *All Laser Downtime*
- Spindle Run out .006 in. to .030 in.
- 12” Vertical Travel on Weld Side

New Workstation Design

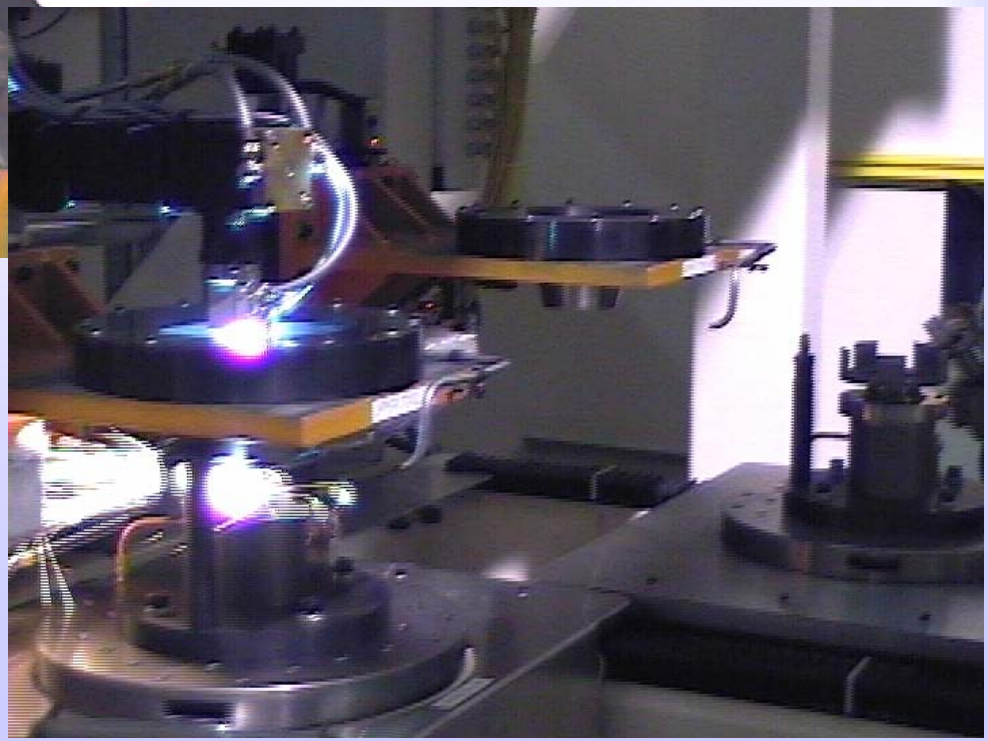
- Twin Weld Spindles / TLC40
- 4 Station Dial Index / Press Table
- High Speed Gantry

Collet Part Holding Details



- Collet

- Twin Spindle



Universal Weld Cell

Challenges:

- Quick Change Tooling
  - Horizontal & Vertical Welding
    - Eleven Unique Welds

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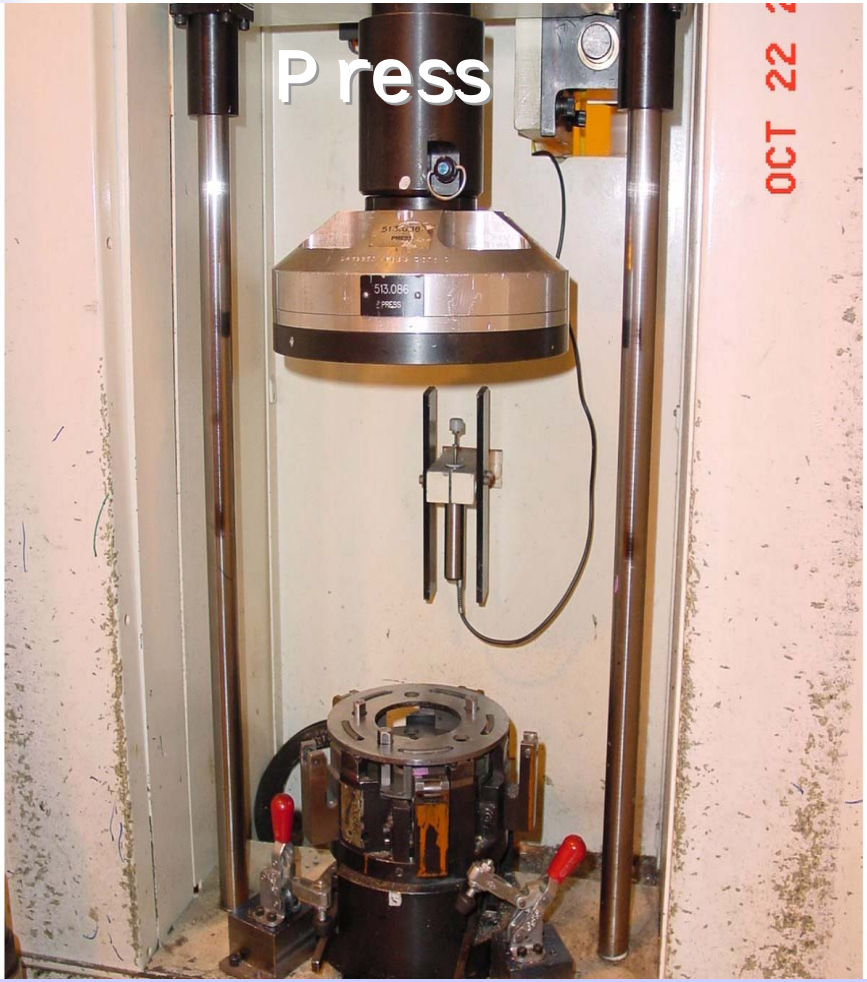
Manual Press & Weld Station



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Modular Tooling Design

Light Weight Design

Load Assist Tooling

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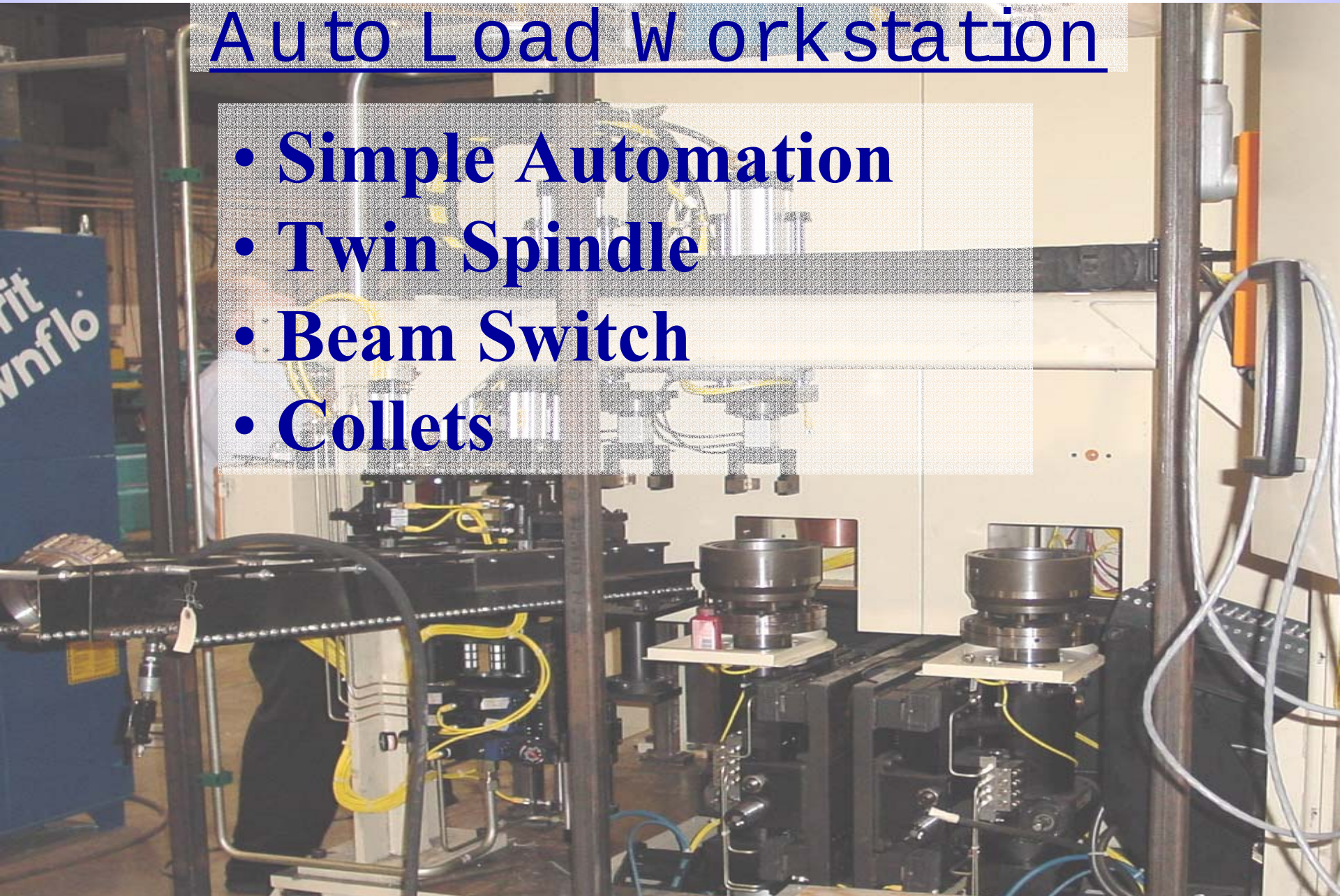
Manual / Auto Load Workstation

- Quick change tooling
- Chuck or Collet part holding
- Gear and shaft welding
- Easily be automated

Auto Load Workstation



- Simple Automation
- Twin Spindle
- Beam Switch
- Collets

Process & Quality Control

Past Inspection Methods:

- 100% Ultrasonic inspection
- High Cost
- Subject to false rejects
- Downtime

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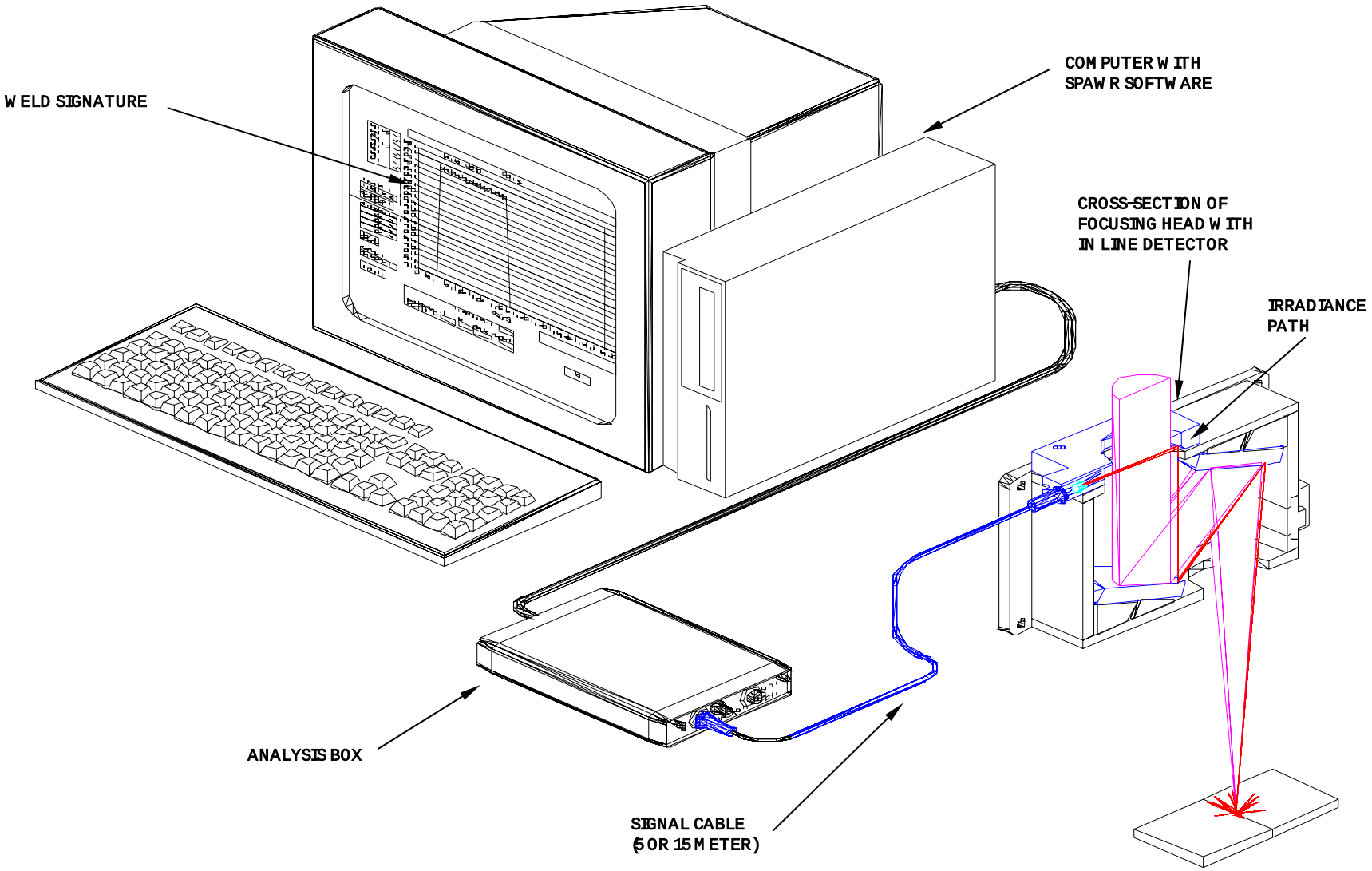
Spawr Real Time Process Monitor



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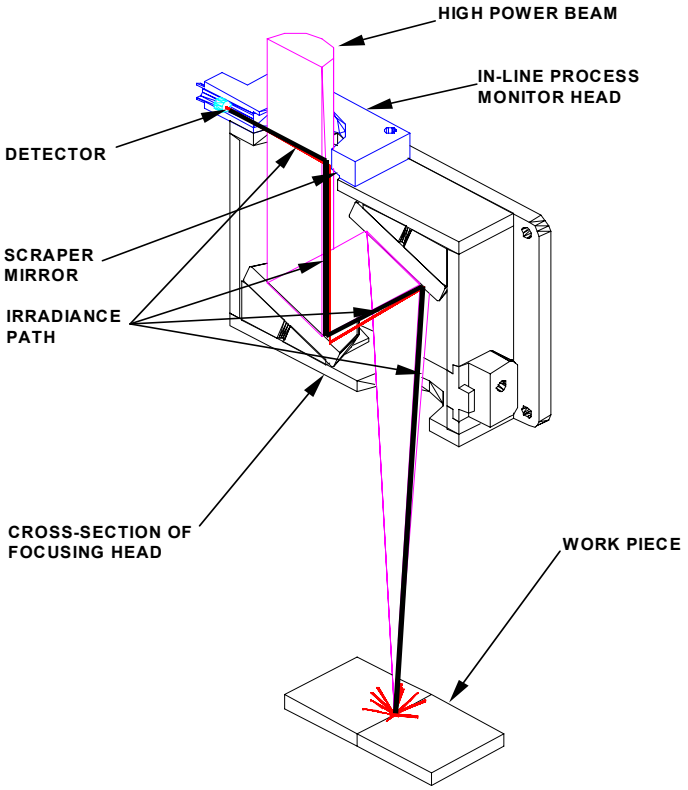
Real Time Process Control

SPAWR

SYSTEM OVERVIEW



- HOW IT WORKS
  - ITEM TO BE WELDED IS STAGED
  - WELD IS STARTED
  - IRRADIANCE FROM WELD POOL IS PRODUCED
  - SCRAPER MIRROR CAPTURES PART OF IRRADIANCE
  - DETECTOR CONVERTS IRRADIANCE TO ELECTRICAL IMPULSE
  - COMPUTER ANALYSIS CONVERTS ELECTRICAL IMPULSES TO GRAPHIC SIGNATURE AND COMPARES TO ESTABLISHED REFERENCE

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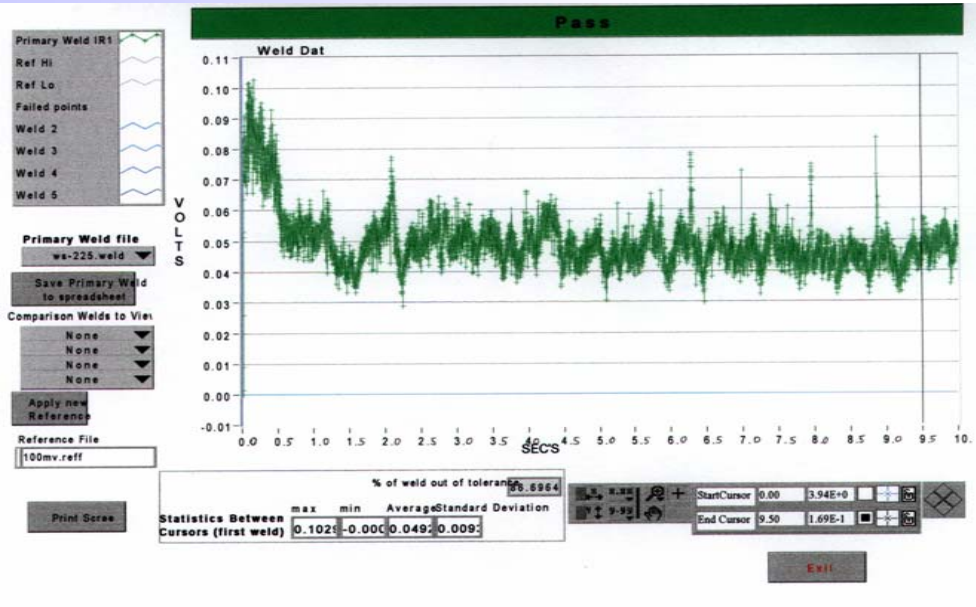
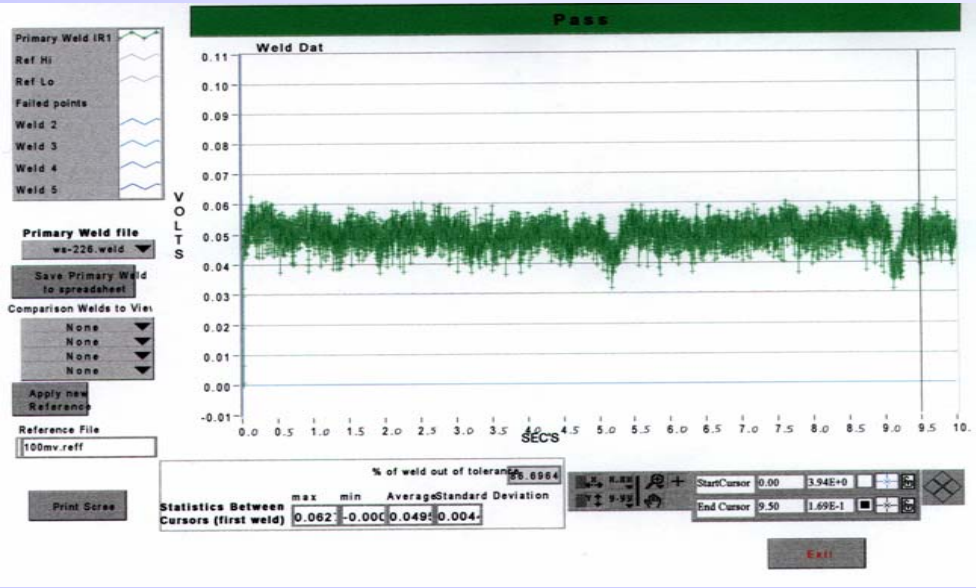
Sample IR Signatures



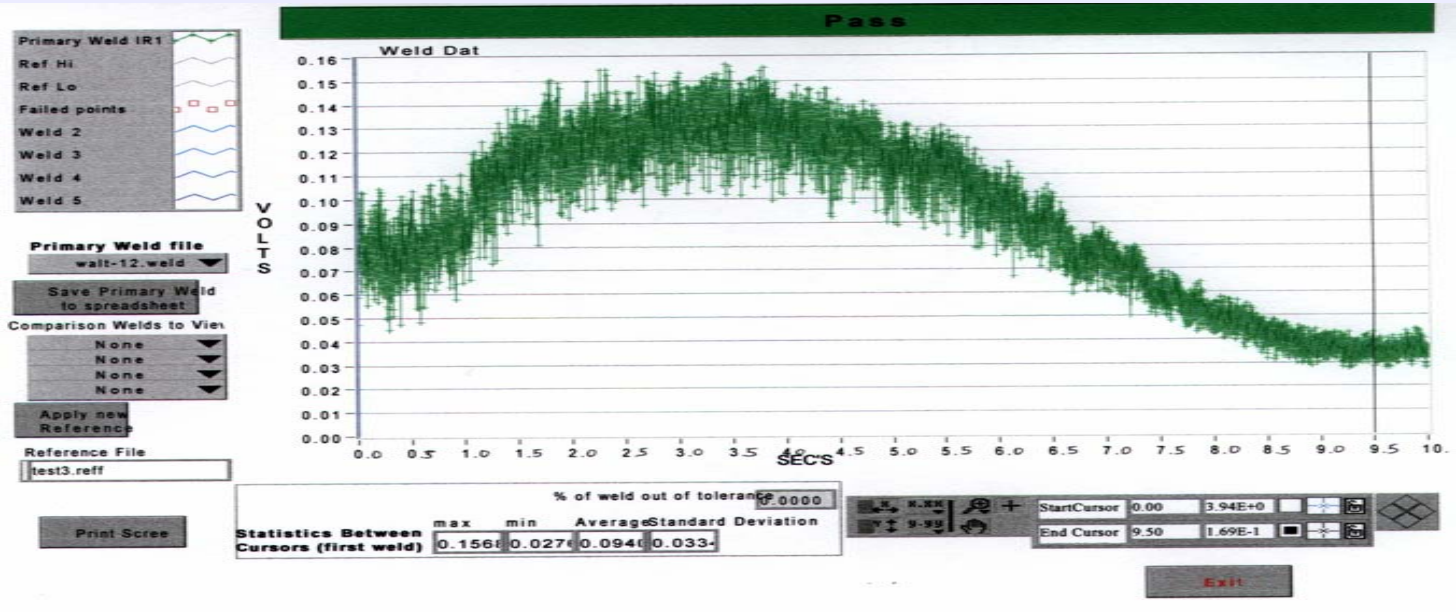
- Signature for a laser weld taking place with no cover gas.



- Same weld except cover gas is flowing in the direction toward the un-welded area.

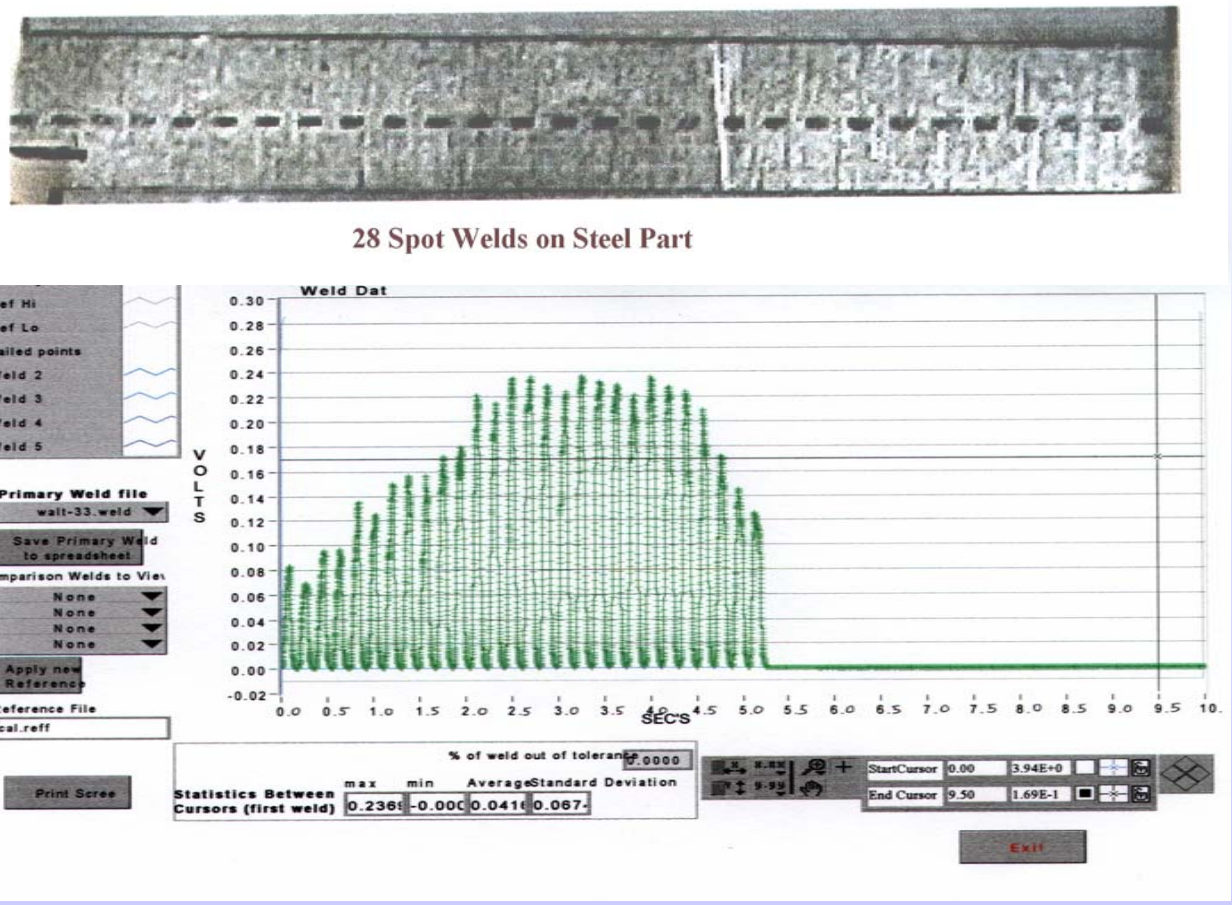
Locating Prime Focus

- Typical signature for CW laser weld moving through the prime focus point.
- Peak (highest average point) of signature indicates prime focus.
- Prime focus is highest irradiance power density of focused beam.



Prime Focus

- For diagnostics purposes chopping or pulsing the beam offers high resolution for locating prime focus.



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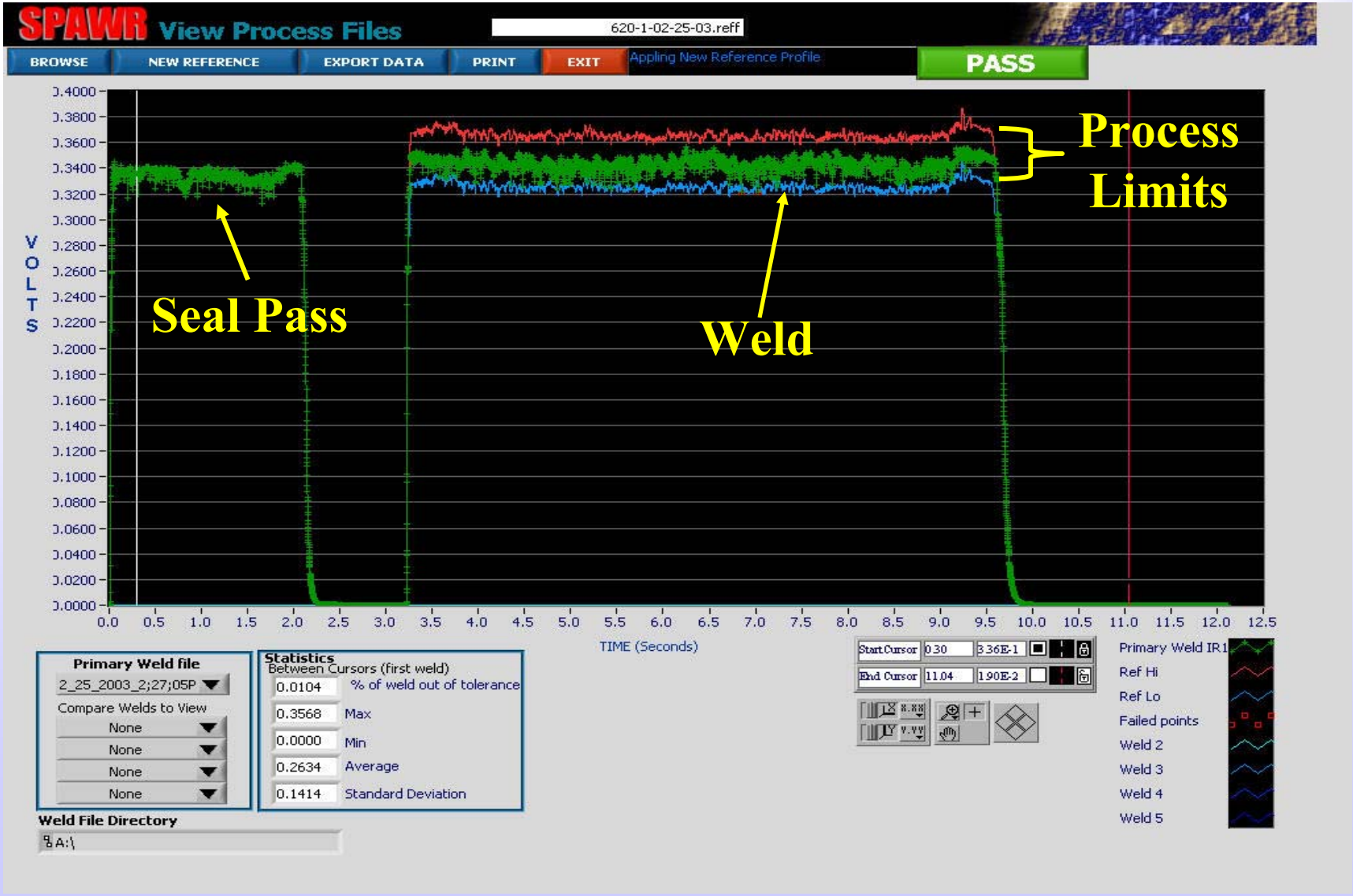
Pass Weld



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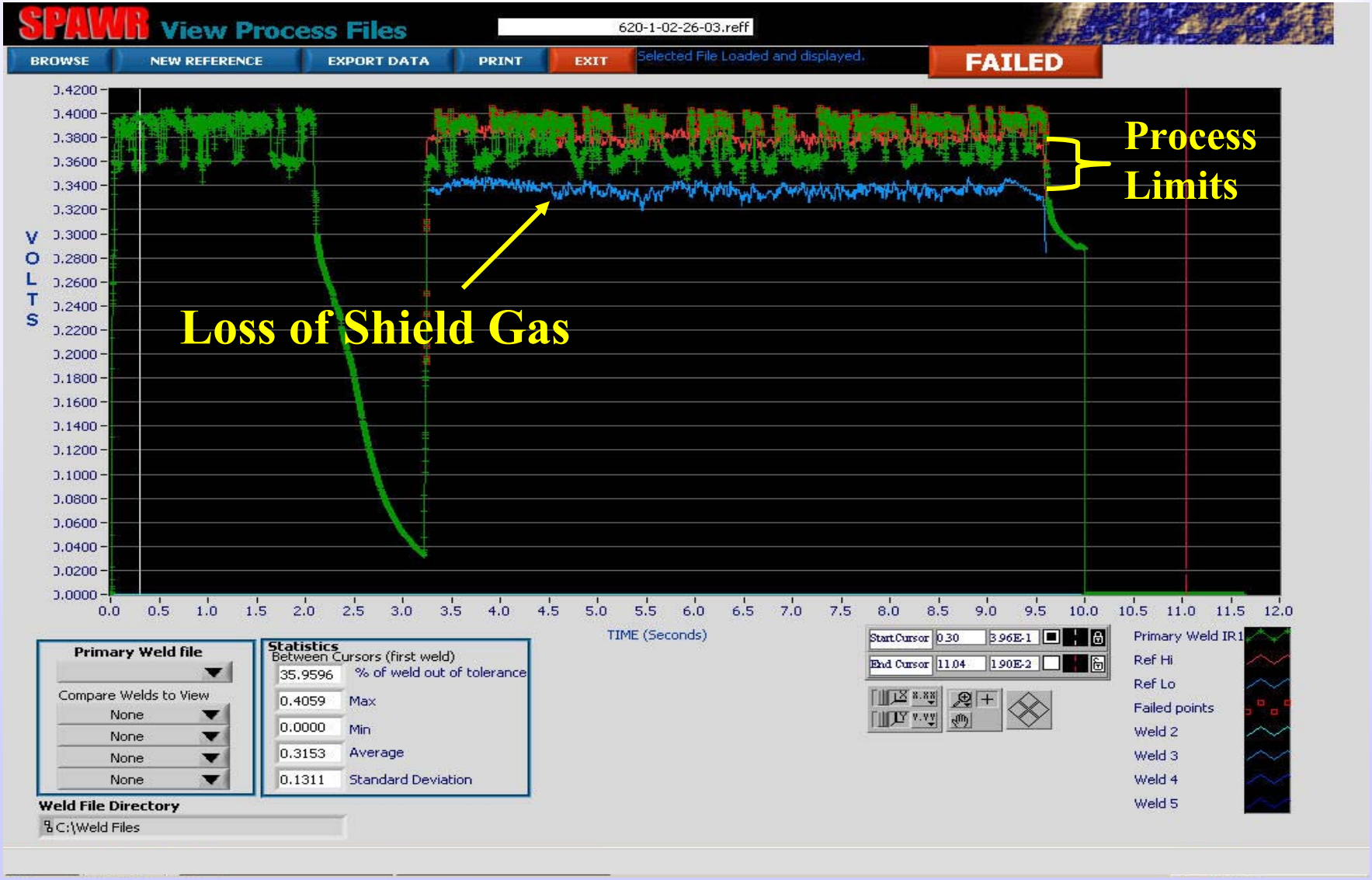
Failed Weld



DODGE

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Jeep

Thank You